

Predictors of Injury Among Adult Recreational In-Line Skaters: A Multicity Study

ABSTRACT

Objectives. This study examined risk factors for injury, injury prevalence, safety gear use, and skating habits of adult recreational in-line skaters.

Methods. Randomly selected in-line skaters in 6 major US cities were interviewed.

Results. Only 6% of skaters consistently wore all 4 recommended types of safety gear. Skaters with greater skating experience were more likely to perform tricks, wear less safety gear, and sustain an injury.

Conclusions. More experienced adult recreational in-line skaters are at increased risk for injury. Safety gear use is alarmingly low in adult recreational in-line skaters, especially experienced skaters. Safe skating education programs should consider targeting this newly recognized at-risk skating population. (*Am J Public Health.* 1999;89:238-241)

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In-line skating is currently one of the fastest growing recreational sports in the United States and is gaining much popularity worldwide. Since its introduction to the general United States population in the 1980s, participation had grown to an estimated 31 million people nationally in 1996, most of the growth occurring within the previous 5 to 7 years.¹ A dramatic increase in injuries due to in-line skating has resulted from this recent rise in popularity. According to the Consumer Product Safety Commission, an estimated 105 000 in-line skating injuries occurred in 1996, representing a 191% increase from 1993.² This has led to an increase in large-scale safety awareness programs.³⁻⁷

Several studies have described frequency rates and types of injuries from in-line skating using injury databases, emergency department case series, or small surveys.⁸⁻¹⁴ However, to date there have been no community-based studies describing risk factors for in-line skating injuries based on skating practices or exposure. In addition, most studies have failed to differentiate among the different types of in-line skaters. The styles of in-line skating can be classified as recreational, aggressive, racing, and roller hockey.⁶

We conducted a cross-sectional survey of adult recreational skaters in 6 major cities in the United States to identify risk factors for injury from in-line skating, estimate the prevalence of such injuries, and describe the use of safety gear and the skating habits of this population.

Materials and Methods

Study Design and Data Acquisition

Subjects were recruited from 6 US cities (New York, Philadelphia, Houston, Chicago, Los Angeles, San Francisco) where recreational in-line skating is popular.¹ The study period was August 1996 to February 1997.

We developed a detailed interview-style questionnaire based on pilot interviews with in-line skaters of different ages and skating abilities. At each of the chosen data collection sites, subjects were randomly selected.

Each data collection site was an area where a large number of skaters were present. Persons wearing in-line skates were potentially eligible, regardless of whether they were actively skating. The interviewers were instructed to focus on one area of the site and choose a potential skater. The interviewer bypassed that particular skater and, on the basis of a predetermined list of randomly generated numbers, counted the *n*th skater in the immediate area, approached that skater, completed the interview, and used the next random number on the list and the same format to determine the next subject. As a means of preventing repeated interviews, potential subjects were asked whether they had participated in the interview at a prior time.

An adult recreational in-line skater was defined as a person 18 years of age or older who participated in in-line skating for at least 1 hour a week for at least 1 month out of the year. The main outcome variable was a self-reported injury within the past year. An injury was defined as an impairment caused by in-line skating that required the skater to change his or her usual skating pattern, take medication, or seek medical attention. When a skater reported an injury, detailed questions were asked about the body part(s) injured, safety gear use, and skating experience at the time of injury. The events that caused the

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injury and the medical treatments received were recorded.

Several variables were selected as possible risk factors. Skating exposure variables included self-reported total months of skating, hours of skating per week, and miles skated per week. Behavioral variables included a history of performing tricks, self-reported skating skill, self-reported safety gear use, and a history of receiving skating instruction. Observed skating gear use was recorded for 200 skaters to validate self-reports. Environmental variables included skating location most often used and history of collisions. Demographic variables included age, sex, education level, marital status, and body mass index (weight in kilograms divided by height in meters squared).¹⁵

Statistical Analysis

Continuous variables were compared via independent-sample *t* tests or Wilcoxon tests, depending on the distribution of the variables. Categorical variable distributions were compared by means of χ^2 statistics. For ordinal variables, we also computed the χ^2 test for trend. Unadjusted odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for all variables of interest. Logistic regression models included all variables that were statistically significant in unadjusted analyses, that were considered clinically important based on a priori hypotheses, or whose addition to the models substantially changed the estimates of the effect of other factors. SAS for Windows, version 6.11 (SAS Institute Inc, Cary, NC), and EGRET, version 0.25.1 (Statistics and Epidemiology Research Corp, Seattle, Wash), were used to perform the analysis.

Results

We interviewed 964 of 1014 skaters randomly selected for participation (response rate: 95%). Of the 964 subjects, 26 were excluded because they were younger than 18 years of age, leaving 938 adult recreational skaters for the analysis. The typical skater was a well-educated, single, healthy adult who skated primarily for exercise or fun, did not take lessons, refrained from doing tricks or stunts, had been in-line skating for approximately 2 years prior to the interview, and skated an average of 6 hours per week (Table 1).

Safety gear use was generally low. Helmets, elbow guards, knee guards, and wrist guards were reportedly used sometimes or never by 76%, 86%, 72%, and 41% of

skaters, respectively. Only 6% of skaters consistently wore all 4 types of safety gear. Agreement rates comparing observed safety gear use and self-reported use ranged from 90% to 95%, depending on the type of gear.

Ninety-nine skaters (11%) reported 118 injuries. The most common body part injured was the wrist (15% of all reported injuries), followed by the knee (12%), and the most common injury types were fractures (19% of all reported injuries) and contusions (19%). Sixty-five percent of injuries required medical attention. The most common circumstances that caused an injury were collisions or trying to avoid collisions (26%), followed by falls while doing tricks (21%). Only 7% of injured skaters were wearing all 4 types of safety gear at the time of injury. Sixty-two percent of skaters had more than 1 year of skating experience before their injury.

Risk factors for injury, as determined by the bivariate analysis, included skating in a street or area with railings and ledges ($P = .001$), a history of performing tricks or stunts ($P = .001$), greater number of hours of skating per week ($P = .001$), greater number of total months skating ($P = .001$), and a self-reported expert skill level ($P = .001$) (Table 2).

Further analysis of those who reported an expert skill level revealed that this group included a significantly higher proportion of men ($P = .001$), skated more hours per week ($P = .0001$), skated more miles per week ($P = .0001$), and had more months of skating experience ($P = .0001$) than the rest of the sample. Also, this group was more likely to skate in areas with railings, ramps, and ledges ($P = .001$); perform tricks or stunts ($P = .001$); wear less safety gear ($P = .001$); and sustain an injury ($P = .001$) than beginners and those at intermediate skill levels.

Independent risk factors for injury, as determined from the logistic regression models (Table 3), included a history of performing tricks or stunts ($P = .03$), number of hours skating per week ($P = .006$), and skating location most frequently used ($P < .001$). The skating location that was most associated with an increased prevalence of injury was an area with railings, ramps, and ledges (vs skating on streets) (adjusted OR = 8.5, 95% CI = 2.5, 29.1). The hours of skating per week variable was associated with the prevalence of injury in a linear dose-response relation, with skating more than 10 hours per week having the highest risk (adjusted OR = 4.0, 95% CI = 1.8, 8.9). It is important to note that performing tricks or stunts was a predictor of injury regardless of the skater's self-reported skill level or level of skating experience.

TABLE 1—Selected Characteristics of Adult Recreational In-Line Skaters in 6 Major US Cities, 1996/97 (n = 938)

Characteristic	Sample
Geographic location, %	
New York	48
Houston	25
San Francisco	9
Philadelphia	7
Chicago	7
Los Angeles	4
Sex, %	
Male	61
Female	39
Marital status, %	
Single	71
Married	23
Divorced	6
Education level, %	
Graduate degree	21
College degree	54
Less than college degree	25
Reason for participation, %	
Exercise	33
Fun	57
Transportation	6
Other	4
Confidence level, %	
Beginner	36
Intermediate	48
Expert	16
Instruction, %	
Lessons	12
Videos/books	4
None	84
Usual skating location, %	
Street	32
Park path	61
Rink	5
Ramps, railings, or ledges	2
Perform tricks or stunts, %	
Yes	25
No	75
Collisions, %	
Yes	36
No	64
Acute injury, %	
Yes	11
No	89
Age, y, mean \pm SD	30 \pm 8
Total months skating, mean \pm SD	25 \pm 21
Hours skating per week, mean \pm SD	6 \pm 6

Note. The survey cities were New York, Philadelphia, Houston, Chicago, Los Angeles, and San Francisco.

Discussion

To our knowledge, this is the first community-based study of in-line skating assess-

TABLE 2—Selected Characteristics of Injured and Uninjured In-Line Skaters in 6 Major US Cities, 1996/97 (n = 938)

Characteristic	Uninjured (n = 839)	Injured (n = 99)	P
Sex, %			.029 ^a
Male	59	71	
Female	41	29	
Total months skating, %			.001 ^b
1–12	29	15	
13–24	36	33	
>24	35	52	
Total months skating, mean ± SD	25 ± 21	32 ± 25	
Hours skating per week, %			.001 ^b
1–2	35	13	
3–5	31	29	
6–10	23	30	
>10	11	28	
Hours skating per week, mean ± SD	6 ± 6	9 ± 7	
Miles skated per week, %			.001 ^b
<5	28	12	
5–9	24	17	
10–19	27	40	
≥20	21	31	
Miles skated per week, mean ± SD	12 ± 14	18 ± 19	
Perform tricks or stunts, %			.001 ^a
Yes	22	45	
No	78	55	
Confidence level, %			.001 ^a
Beginner	37	19	
Intermediate	48	54	
Expert	15	27	

Note. The survey cities were New York, Philadelphia, Houston, Chicago, Los Angeles, and San Francisco.

^aDerived from χ^2 test comparing the given attribute between the injured and uninjured skaters.

^bTest for trend.

recreational skaters were most likely to perform tricks while skating, wear less safety gear, and sustain an injury. Another important finding was the overall low rate of safety gear use reported among all adult in-line skaters.

Previous studies of in-line skating injuries have been based on injury databases, emergency department series, or small surveys.^{8,9,11–14} We believe that the present study design had several advantages over these types of studies. Through this survey, we obtained data from a large sample of both uninjured skaters and injured skaters, including those whose injuries did not necessarily result in emergency department care. In addition, through an in-depth standardized interview, we were able to obtain detailed information regarding skating exposure, skating habits, and specific events surrounding reported injuries. To enhance the generalizability of our study, we used a large sample of randomly selected skaters, achieved a high response rate, and recruited subjects from 6 cities in various regions of the United States.

However, our study design did involve some limitations. Information bias may have occurred because data were based on self-report and, with the exception of safety gear use, could not be validated. Selection bias may have been present because skaters who had sustained a severe injury previously may have been excluded from the current general skating population. Thus, the prevalence of severe injuries may have been underestimated. The results and conclusions of the present study pertain only to adult recreational in-line skaters.

Most of the concern regarding in-line skating injuries has been directed toward beginners.^{3–7} Most studies to date have reported that beginners are at the greatest risk for injury and that the events causing injury are most often due to a loss of balance or a change in skating surface.^{10–12,14,16} In the present study, the most commonly injured skater was a self-reported expert with more than 1 year of skating experience, and the most common circumstances that caused an injury were collisions or performing tricks while skating. Based on our findings, we believe that more experienced adult recreational in-line skaters are at an increased risk for injury. To date, this at-risk population has not been recognized.

In conclusion, we recommend that safe skating education programs recognize this at-risk population and consider specifically targeting more advanced skaters in their campaign messages. Advanced skaters should be made aware that, even after they have learned the basic skating techniques

TABLE 3—Risk Factors for Injury From In-Line Skating

	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	P
Hours skating per week			.006
1–2	Reference	Reference	
3–5	2.5 (1.3, 5.0)	2.1 (1.1, 4.3)	
6–10	3.5 (1.8, 6.8)	2.6 (1.2, 5.4)	
>10	6.3 (3.1, 12.7)	4.0 (1.8, 8.9)	
Usual skating location			<.001
Street	Reference	Reference	
Ramps, rails, ledges	9.5 (3.2, 28.0)	8.5 (2.5, 29.1)	
Park path	0.5 (0.3, 0.8)	0.7 (0.4, 1.2)	
Rink	0.6 (0.2, 1.9)	0.5 (0.2, 1.6)	
Perform tricks or stunts			.03
No	Reference	Reference	
Yes	2.8 (1.8, 4.3)	1.8 (1.1, 3.0)	
Education level			.01
Less than college	Reference	Reference	
College degree	0.9 (0.6, 1.4)	1.5 (0.9, 2.7)	
Graduate degree	0.4 (0.2, 0.8)	0.6 (0.3, 1.3)	

Note. CI = confidence interval.

ing risk factors for injury. The results from this large survey indicate that skating location, performing tricks while skating, and

skating more hours per week are significant predictors of injury from in-line skating. In this adult population, more experienced

and gained confidence in their skating ability, they still have a substantial risk for injury and should continue to adhere to fundamental safety principles. More important, the performance of tricks while skating places a skater at significantly higher risk for injury, regardless of the skater's experience level. Targeting and educating more experienced skaters in safe skating campaign messages may assist in lowering rates of injury due to in-line skating. □

Contributors

Richard Seldes designed and planned the study, analyzed the data, oversaw and conducted the standardized interviews, and wrote the paper. Jeff Pavell, Virak Tan, and Brock Bowman contributed to the design and planning of the study, analyzed the data, conducted the standardized interviews, and contributed to the writing of the paper. Jeane Grisso, Jesse Berlin, and Judith Kinman designed and planned the statistical analysis and contributed to the writing of the paper. Robert Fitzgerald contributed to the planning of the study, analysis of the data, and

writing of the paper. All authors are guarantors for the integrity of the research.

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Wife Abuse Among Women of Childbearing Age in Nicaragua

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ABSTRACT

Objectives. This study measured the prevalence, frequency, and severity of physical wife abuse and its risk factors in León, Nicaragua.

Methods. A cross-sectional survey was conducted with a representative sample of 488 women 15 to 49 years of age.

Results. The lifetime prevalence of spousal violence was 52% among ever-married women ($n = 360$). Spousal violence was significantly positively associated with poverty, parity, urban residence, and history of violence in the husband's family. No significant associations were found between spousal violence and women's age, education, marital dependency, or occupation.

Conclusions. Wife abuse constitutes a major public health problem in Nicaragua, requiring urgent measures for prevention and treatment for victims. (*Am J Public Health*. 1999;89:241–244)

Wife abuse is increasingly recognized as a global public health concern.¹ Although reliable prevalence data are scarce, it is estimated that between 20% and 50% of women in most countries have experienced physical violence from an intimate partner.^{2–6} Wife abuse has been associated with a variety of adverse health outcomes for women and children, including trauma,^{7,8} low birthweight,^{9,10} gynecological disorders,¹¹ depression,^{12,13} suicide,¹⁴ and sexually transmitted diseases.¹⁵ Few studies have found significant risk factors among women for wife abuse,^{16,17} although some risk factors have been consistently associated with violent men, such as witnessing violence as a child, poverty, stress, alcohol use, and cultural norms that discriminate against women.^{16,18–20} Awareness regarding wife abuse has increased greatly in Nicaragua, in part as a result of the growing number of nongovernmental organizations providing health, legal, and psychological services for battered women, as well as advocacy to improve laws and public policy with regard to domestic violence.^{21,22} Although the reported incidence of wife abuse has increased,²³ it is unknown, in the absence of

population-based data, whether this reflects an actual increase or improved reporting.

Methods

This article presents the results of the first population-based survey carried out in Nicaragua on wife abuse. The study aimed to

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